

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 13, 1906.—“Experiments on the Length of the Kathode Dark Space with Varying Current Densities and Pressures in Different Gases.” By F. W. **Aston**. Communicated by Prof. J. H. Poynting, F.R.S.

This paper deals with experiments on the length of the “Crookes” dark space under steady currents in air, oxygen, nitrogen, and hydrogen, and its relation to pressure, current density and potential in a cylindrical glass discharge tube, the electrodes of which are large aluminium discs closely fitting the tube. Under these conditions it is found that so long as the current is kept above a certain value, *i.e.* sufficient to cover the kathode with glow and to cause the complete disappearance of the positive light on the anode, the distance between the electrodes has quite a negligible effect upon the dimensions of the dark space, the current, and the potential. The current ceases abruptly, however, when the length of the dark space becomes the same as that distance; also the negative glow terminates sharply (in the case of oxygen amazingly so) over the greater part of its area at a plane exactly parallel to the kathode at a distance from it (*D*) accurately measurable by means of a simple sighting arrangement. In order to eliminate edge effects and to get a more exact measure of current density, the kathode used was in the form of a disc and guard-ring, that current passing through the disc only being measured. If *P*=pressure, *c*=current density, *V*=potential between electrodes, then very approximately

$$D = \frac{A}{P} + \frac{B}{\sqrt{c}} \quad V = \frac{F}{P} \sqrt{c} + E,$$

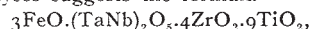
A, *B*, *F*, and *E* being constants for a given gas, the last being very nearly the same as the accepted values of kathode fall with aluminium electrodes in the gas.

These empirical relations, together with other observations, led to the conclusion that *the dark space may be regarded as a region of positive electrification travelling towards the kathode, in which the total positive charge exactly balances the negative charge on the kathode*. The theoretical fall of potential across such a region in which the density of negative electrification is assumed negligible

is shown to be $\left(\frac{8\pi c}{\lambda}\right)^{\frac{1}{2}} D^{\frac{3}{2}}$, where λ is the velocity of a positive ion in a unit field and *c* is the density of the current carried by the positive ions, so that if the latter bear a constant relation to the whole current density passing through the tube, we should expect cPD^3V^{-2} to be a constant for any gas. This is found to be the case for all values of the dark space between 0.5 cm. and 2.0 cm. in the gases under investigation. From the values so obtained the velocities of positive ions at the very low pressures (of the order of 0.2 mm. mercury) employed are calculated, and shown to be of the order expected from the values at atmospheric pressure determined by Zeleny. The stream of positive ions may be strikingly shown by a rotatory mica mill mounted *inside* the dark space, which rotates violently in the *opposite* direction to the familiar ones designed to show the motion of kathode rays away from the electrode. Suggestions are put forward to account for the almost incredible “sharpness” of the edge of the negative glow in oxygen, the most remarkable phenomenon of the investigation.

Mineralogical Society, March 19.—Prof. H. A. Miers, F.R.S., president, in the chair.—The silver deposit or Sedgman lode in the Perran Mine, Cornwall: F. H. **Butler**. The lode runs through killas in an approximately north and south direction. The silver ore, consisting almost solely of cerargyrite, occurs in compact masses or finely disseminated in a gossany limonite. Splintery and ferruginous quartz, the “cab-course,” is always a well-developed feature in the richest parts of the lode. The distribution of the cerargyrite, to the depth of 18 fathoms to which the mine has been worked, is roughly in accordance with the surface contour of the land, but segregations have also taken place along a series of lines running from

above downwards. The source of the chlorine, the author suggests, might be sea water that has reached abyssal regions.—The minerals of the Silvermines District, co. Tipperary: A. **Russell**. The mines extend along an east and west line of fault in which Silurian, Old Red Sandstone, and Carboniferous rocks are brought into juxtaposition. Along its course in certain places mineralisation has taken place, resulting in contact lodes and metasomatic deposits. In the Ballygowan South mine is an interesting occurrence of hemimorphite, the only one of the kind known in the United Kingdom. The mineral is found in brilliant crystals lining cavities in limonite. The gossan also contains irregular masses of argentiferous galena, partially altered to cerrusite. At the Ballynue mine, copper pyrites, galena, and barytes form a lode between walls of Silurian and Carboniferous limestone. At the Gortnadyne mine argentiferous tetrahedrite is found with copper pyrites and cerrusite (“cat-tooth ore”). An extensive series of old open workings of galena can be seen at the Shallee East mine.—Baddeleyite from Ceylon: G. S. **Blake** and G. F. Herbert **Smith**. Three brilliant crystals of the mineral were picked out from a number of specimens of the heavy minerals from the gem district of Ceylon which were sent to the Imperial Institute in 1905. Of the three crystals, one possessing only the prism zone was used for analysis, and found to contain nearly 99 per cent. of zirconia. On the other two crystals, one of which was a twin, were observed eleven forms, including one new one (210).—Zinciferous tennantite from the Binnenthal: R. H. **Solly** and G. T. **Prior**. Crystals of tennantite, one of which was a large cube, with faces deeply striated parallel to small tetrahedral faces, were found on analysis to contain nearly 8 per cent. of zinc.—Strüverite, a new mineral: F. **Zambonini** and G. T. **Prior**. This new mineral was found in detrital masses of pegmatite near Craveggia, in N. Piedmont. Crystallographically it is very similar to rutile and tapiolite, with axial ratio *a*:*c*=0.6456. Some of the crystals are elongated along the pyramid edge, and are probably twins similar to those of ilmenorutile. The mineral is black and opaque, and has a specific gravity of 5.59. It contains titanate acid, zirconia, oxide of iron, and niobic and tantalate acid. The result of analyses suggests the formula



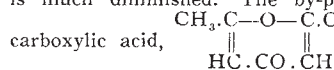
which may be written as a mixture of the three molecules $\text{Fe}(\text{TaNb})_2\text{O}_6$, FeZr_2O_6 , and TiTi_2O_6 in the proportion of 1:2:3. Chemically it is very similar to ilmenorutile, but contains about 28 per cent. of ZrO_2 replacing part of the TiO_2 .

Zoological Society, March 19.—Dr. Henry Woodward, F.R.S., vice-president, in the chair.—Recently discovered subfossil Prosimiæ from Madagascar, and their affinities with extant lemurs and with the higher Primates: H. F. **Standing**. The remains were obtained in the muddy bed of a swamp formed by the blocking up of the river Mazy by a lava flow, at from a few inches to 3 feet or 4 feet below the surface. They consisted of a large number of skulls and limb-bones of lemurs and lemur-like animals. This great amount of material enabled the author to corroborate the view, previously put forward by Dr. Forsyth Major, that the extinct lemurs of Madagascar were, in many respects, intermediate between existing lemurs and monkeys, and to express his belief that the New World monkeys and the Lemuridæ, as well as the Malagasy Indrisinæ, had a common origin. He also stated his opinion that it was not possible to separate the Primates, as hitherto, into the two suborders Lemuroidea and Anthropoidea.—Animal parasites: Dr. L. W. **Sambon**. Three new species were described:—*Wellcomia mitchelli*, gen. et sp. nov., habitat, small intestine of *Pedetes caffer*; *Sparganum baxteri*, sp.n.? habitat, connective tissue of man; *Schistosomum mansonii*, sp.n., habitat, blood-vessels of man. Dr. Sambon also described five new Hæmogregarines discovered by Dr. C. G. Seligmann and himself in snakes.—A collection of mammals, the seventh of the series, made by Mr. C. H. B. Grant at Coguno, Inham-bane, and presented to the National Museum by Mr. C. D. Rudd: Oldfield **Thomas** and R. C. **Wroughton**. The collection consisted of 212 specimens belonging to thirty-nine species, of which six were described as new.

Entomological Society, March 20.—Mr. C. O. Waterhouse, president, in the chair.—Dr. F. A. **Dixey** exhibited several species of *Phrissura* and *Mylothris*, illustrating the remarkable parallelism between different forms of the two genera, a correspondence believed by the exhibitor to have a mimetic significance, the mimicry being probably of the Müllerian kind.—The following papers were communicated:—Studies of the Tetriginæ in the Oxford Museum: J. L. **Hancock**.—A list of the Coleoptera of the Maltese Islands: M. **Cameron**, R.N., and A. **Camana**.—The life-history of *Spindasis lohila*, Horsf.: J. C. **Kershaw**.—The egg cases and early stages of some South China Cassididæ: J. C. **Kershaw** and F. **Muir**.—The life-history of *Tessaratomia papillosa*, Thunb., with notes on the stridulating organ and stink gland: F. **Muir** and J. C. **Kershaw**.—The vinegar fly (*Drosophila funebris*): E. E. **Unwin**.—The structure and life-history of the holly fly: Prof. L. C. **Miall** and T. H. **Taylor**.—Note on *Xanthorhoe ferrugata*, Clerck: L. **Doncaster**.

Chemical Society, March 21.—Sir Henry E. Roscoe, F.R.S., past-president, in the chair.—Synthesis of polypeptides: E. **Fischer**. Continuing his work on the synthesis of polypeptides, the author has prepared an octadecapeptide containing fifteen glycolyl and three *l*-leucine residues.—Organic derivatives of silicon, part iii., *dl*-benzylmethylpropylsilicane and experiments on the resolution of its sulphonic derivative: F. S. **Kipping**. *dl*-Benzylmethylpropylsilicane is sulphonated by sulphuric acid at about 130°, yielding a mixture of acids, of which two, benzylethylpropylsilicolsulphonic acid and *dl*-benzylmethylpropylsilicane-sulphonic acid, were isolated in the form of their *l*-menthylamine salts.—The reduction of carbon dioxide to formaldehyde in aqueous solution: H. J. H. **Fenton**. By the action of metallic magnesium on an aqueous solution of carbon dioxide, recognisable quantities of formaldehyde can be obtained, and the amounts formed are considerably increased in the presence of weak bases.—The mechanism of the rusting of iron: G. T. **Moody**. An experiment was described and shown which proved that in the formation of iron rust the metal must actually first pass into solution, and hence confirmation is obtained of the view that an acid, e.g. carbonic acid, is an essential factor in the rusting of iron.—Influence of non-electrolytes and electrolytes on the solubility of sparingly soluble gases in water. The question of hydrates in solution: J. C. **Philip**. The influence of non-electrolytes and electrolytes on the solubility of gases may be interpreted by supposing (1) that the non-solute takes no part in the absorption, and (2) that hydration of the non-electrolyte or electrolyte may occur, and the solvent thus attached is no longer free to absorb the gas.—A new class of organo-metallic compounds. Preliminary notice. Trimethylplatinimethyl hydroxide and its salts: W. J. **Pope** and S. J. **Peachey**. The chlorides of iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium, platinum, and gold react vigorously with magnesium methyl iodide; trimethylplatinimethyl iodide, the corresponding hydroxide, nitrate, chloride, bromide, and cyanide have been prepared by this means.—Some compounds of guanidine with sugars, part i.: R. S. **Morrell** and A. E. **Bellars**.—The action of aluminium chloride on naphthalene. Formation of $\beta\beta$ -dinaphthyl, tetranaphthyl, and tetramethylethyrene; Miss A. **Homer**.—Mercurous hyponitrite: P. C. **Rây**.—The decomposition of mercurous and silver hyponitrites by heat: P. C. **Rây** and A. C. **Gañguli**. From the results obtained the authors are of opinion that these salts have both an oxylic and imidic constitution.—Studies in optical superposition, part iii.: T. S. **Patterson** and J. **Kaye**. The results of observation of the rotation of *l*-menthyl diacetyl-tartrate, both in the homogeneous state and in solution in ethyl alcohol, benzene, and nitrobenzene, taken in conjunction with those previously published (Trans., 1905, lxxxvii., 33; 1906, lxxxix., 1884), furnish thoroughly valid evidence as to the untenability of van 't Hoff's assumption regarding optical superposition.—An extension of the benzoin synthesis: R. W. L. **Clarke** and A. **Lapworth**. Benzylideneaniline hydrocyanide condenses with carvone and with benzylidenacetophenone to form respectively phenylimino- β -benzoyldihydrocarvone and

γ -cyano- α -benzoyl- γ -anilino- $\beta\gamma$ -diphenylpropane. — Interaction of starch and carbon disulphide. Xanthogenic esters of starch: C. F. **Cross**, E. J. **Bevan**, and J. F. **Briggs**. Starch moistened with the disulphide and then treated with a sodium hydroxide solution is brought into the condition for quantitative reaction and conversion into the xanthogenic ester (sodium salt).—The estimation of small quantities of nitrogen peroxide: R. **Robertson** and S. S. **Napper**. The method depends on the changes observed in the characteristic absorption spectrum of nitrogen peroxide as its concentration in dilute mixtures is increased.—The evolution of nitrogen peroxide in the decomposition of guncotton: R. **Robertson** and S. S. **Napper**.—An isomeric change of dehydracetic acid: J. N. **Collie** and T. P. **Hilditch**. If sulphuric acid of about 85 per cent. instead of about 90 per cent. is allowed to act on dehydracetic acid, the yield of triacetic lactone is much diminished. The by-product formed is pyrone-



PARIS.

Academy of Sciences, March 25.—M. A. Chauveau in the chair.—The approximate theory of the flow over a vertical weir, with sharp edge, without lateral contraction and in a free sheet: J. **Boussinesq**. A further approximation of a formula arrived at in a previous paper. The results are in accord with the experimental figures of M. Bazin.—Contribution to the study of phosphorescence: Henri **Becquerel**. The images of two specimens of the same phosphorescent salt, one being at the ordinary temperature and the other at the temperature of liquid air, were thrown simultaneously on the slit of a spectro-scope. The changes thus noted for several uranium salts in the phosphorescent spectra are given in detail. The increased sharpness of the bands at the lower temperature enabled the polarisation effects to be studied. Those salts of uranium which can be obtained in well-defined crystals, cooled to the temperature of liquid air, and illuminated with violet light, show no change in the spectrum when the incident light is polarised, but a change in the spectrum is observed if a Nicol is interposed between the phosphorescent crystal and the spectro-scope.—A generalisation of the movement of Ponsot: L. **Lecornu**.—The coefficient of resistance of air to be adopted in calculations regarding aeroplanes: F. **Ferber**.—Rotatory magnetic polarisation in the neighbourhood of absorption bands. The magnetic rotatory power of crystals at the temperature of liquid air: Jean **Becquerel**.—The theory of the radiation of incandescent mantles: M. **Foix**. It is shown that the sole function of the thorium oxide is to form a support for the cerium oxide.—The influence of the surrounding temperature on the luminous intensity of an incandescent electric lamp: F. **Laporte** and R. **Jouvaux**. A theoretical investigation of the effect of increase of temperature on the luminous intensity of an electric lamp shows that for a rise of 100° C. in the temperature of the lamp an increase in the luminosity of 0.4 per cent. might be expected. Direct experiment showed that the light remained constant for a rise of 100° C., and as the experimental error was of the order of 1 per cent., this is in agreement with the theoretical figure.—The supplementary channelling of spectra produced by parallel gratings: Georges **Meslin**.—The function and the nature of the initial discharge in the electric spark: G. A. **Hemsalech**.—The formation of ammonia gas from its elements under the influence of the electric spark; the influence of pressure: E. **Briner** and E. **Mettler**. The concentration of ammonia gas formed by electric sparks in a closed vessel attains a limit of about 3 per cent. to 4 per cent. at the ordinary temperature. If, however, the reaction vessel has its lower end placed in liquid air, the ammonia is condensed as fast as it is formed, and the reaction becomes complete. Working in this way, and starting with a mixture of nitrogen and hydrogen in the correct proportions, a nearly total vacuum can be obtained in the apparatus. A curve is given showing the effect of pressure on the yield; a pressure of 100 mm. of mercury was found to be the most favourable, the yield being 0.17 gram of

ammonia per kilowatt hour.—The age of the calcareous strata in the neighbourhood of Athens: Const. A. Ktenas.

April 2.—M. A. Chauveau in the chair.—The calculation of the inferior contraction of the sheet flowing over a weir with sharp edge and moderate height, and fitted with a horizontal plate above: J. Boussinesq.—An extension of the summation method of M. Borel: A. Buhl.—The nature of the body extracted from certain rich alloys of nickel and tin: Em. Vigouroux. Following the methods described in a previous paper, the substance NiSn has been isolated as a crystalline powder, showing brilliant facets under the microscope. It is non-magnetic, and has a density of 8.44, the density calculated from its composition on the assumption of no contraction being 7.93.—The influence of manganese salts on alcoholic fermentation: E. Kayser and H. Marchand. The increased yield in alcohol resulting from the addition of minute proportions of manganese salts has been shown in a previous paper. It is now shown that yeast thus treated preserves its acquired properties through several generations, and the practical applications of this fact are indicated.—Rectal gills in the larvæ of *Simulium damnosum*. The adaptation of a larva of *Simulium* to life in the streams of equatorial Africa: E. Roubaud.—The nephro-poietic activity of the blood and of the kidney in the course of the renal regenerations: P. Carnot and A. Lelièvre.—The evolution of carbon, water, and ash as a function of the age in plants: J. Tribot.—Some seismic constants deduced from the earthquake of April 4, 1904: E. Oddone.

DIARY OF SOCIETIES.

THURSDAY, APRIL 11.

ROYAL INSTITUTION, at 3.—The Birth and Affinities of Crystals: Prof. Henry A. Miers, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—A Theorem in the Theory of Functions: Dr. H. F. Baker.

FRIDAY, APRIL 12.

ROYAL INSTITUTION, at 9.—Conservation of Historic Buildings and Frescoes: Prof. A. H. Church, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—An Engineer's Visit to Japan and Canada: R. W. Allen.

MALACOLOGICAL SOCIETY, at 8.—Notes on New Zealand Polyplocophora, with Descriptions of Five New Species: H. Suter.—Descriptions of New Mollusca from New Caledonia: G. B. Sowerby.—Some New Species of *Drymaeus* from Peru, Mexico, &c.: S. I. Da Costa.—A New Species of *Vallonia* from India: G. K. Gude.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Continued discussion:—Petrol Motor-Omnibuses: W. Worby Beaumont.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Early and late Perseid: W. F. Denning.—Determinations of Personal Equation depending on Magnitude, made with the Transit-Circle and the Heliometer at the Royal Observatory, Cape of Good Hope: Sir D. Gill and S. S. Hough.—Determination of the Secular Perturbations of the Minor Planet Ceres, arising from the Actions of the Eight Major Planets: C. J. Merfield.—The Electric Arrangements of an Observatory: W. E. Cooke.—*Probable Papers*: The Perturbations of Halley's Comet: P. H. Cowell and A. C. D. Crommelin.—On the Value of the Solar Parallax from the Greenwich Photographs of Eros, 1899-1900: Royal Observatory, Greenwich (Communicated by the Astronomer Royal).

SATURDAY, APRIL 13.

ROYAL INSTITUTION, at 3.—Studies in Magnetism: Prof. Silvanus P. Thompson, F.R.S.

MONDAY, APRIL 15.

SOCIETY OF ARTS, at 8.—Detergents and Bleaching Agents used in Laundry Work: Prof. Herbert Jackson.

TUESDAY, APRIL 16.

ROYAL INSTITUTION, at 3.—Wings and Aeroplanes: Prof. G. H. Bryan, F.R.S.

SOCIETY OF ARTS, at 8.—Joinery and Furniture Making: A. Romney Green.

ROYAL STATISTICAL SOCIETY, at 5.

ANTHROPOLOGICAL INSTITUTE, at 8.15.—Note on some Palæolithic and Neolithic Implements from East Lincolnshire: S. H. Warren.—Exhibition of Flints from Cornwall: A. L. Lewis and S. H. Warren.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Pyrmont Bridge: P. Allan.—Swing Bridge over the River Avon at Bristol: W. H. B. Savile.

WEDNESDAY, APRIL 17.

GEOLOGICAL SOCIETY, at 8.—The Toadstones of Derbyshire: their Field-Relations and Petrography: H. H. Arnold-Bemrose.—Data bearing on the Age of Niagara Falls: Prof. J. W. W. Spencer.

ROYAL MICROSCOPICAL SOCIETY, at 8.—On the Podura Scale: E. M. Nelson.—Exhibition of Slides of Foraminifera: A. Earl and

SOCIETY OF ARTS, at 8.—Aerial Navigation: Major B. F. S. Baden-Powell.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Phenomenal Rainfall in Suva, Fiji, August 8, 1905: R. L. Holmes.—Temperature around the British Islands in Relation to the Gulf Stream: R. Strachan.—Weather regarded as a Function of Climate: L. C. W. Bonacina.

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THURSDAY, APRIL 18.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On Reciprocal Innervation of Antagonistic Muscles: Tenth Note: Prof. C. S. Sherrington, F.R.S. Fatty Degeneration of the Blood: S. G. Shattock and L. S. Dudgeon.—(1) The Rate of the Assumption of Chloroform by the Blood during Anaesthesia; (2) Function of the Red Corpuscles in Chloroform Anaesthesia: G. A. Buckmaster and J. A. Gardner.—The Fermentation of Glucosides by Bacteria of the Typhoid-coli Group, and the Acquisition of New Fermenting Powers by *Bacillus Dysenteriae* and other Micro-organisms: F. W. Twort.

ROYAL INSTITUTION, at 3.—The Birth and Affinities of Crystals: Prof. Henry A. Miers, F.R.S.

LINNEAN SOCIETY, at 8.—On the Ecologic Functions of Stolons and Cleistogamous Flowers: J. C. Shenstone.—On the Ecologic Aspect of Constitutional Variation in Fruit-culture: A. O. Walker.—On an Aberrant Form of Coccidæ: Hugh Scott.—Some Results of Inoculation of Leguminous Plants: Prof. W. B. Bottomley.—*Exhibits*: Nepal Barley and other Cereals cultivated at High Altitudes in Tibet: Dr. George Henderson.—Photographs of Sections of Woods: J. A. Weale.—Lantern Slides of Witches' Brooms: J. Saunders.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Flexibles: with Notes on the Testing of Rubber: A. Schwarz.

CHEMICAL SOCIETY, at 8.30.—The Magnetic Rotation of Hexatriene, $\text{CH}_2:\text{CH}:\text{CH}:\text{CH}:\text{CH}_2$, and its Relationship to Benzene and other Aromatic Compounds, also its Refractive Power: Sir W. H. Perkin.—Aromatic Azimides, Part i., β -Hydroxyphenylazimide: M. O. Forster and H. E. Fierz.—The Action of Hydrogen Peroxide on Potassium Cyanide: O. Masson.—The Action of Ethyl Oxalate on Thioacetanilide and its Homologues: S. Ruhemann.—Measurements of the Velocities of Saponification of the *l*-Menthyl and *l*-Bornyl Esters of the Stereocyclic Mandelic acids: A. McKenzie and H. B. Thompson.—Indian: Preliminary Notice: A. G. Perkin and W. P. Bloxam.—Cupric Nitrite: P. C. Ray.—The Constituents of the Essential Oil of American Pennyroyal: Occurrence of a Dextro-Menthone: M. Barrowcliff.—The Action of Tribromopropane on the Sodium Derivative of Ethyl Acetate: T. E. Gardner and W. H. Perkin.

FRIDAY, APRIL 19.

ROYAL INSTITUTION, at 9.—Nerve as a Master of Muscle: Prof. C. S. Sherrington, F.R.S.

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